AMENDMENTS TO THE CLAIMS

This listing of claims will replace all prior versions, and listings, of claims in the application:

Listing of the Claims

1. (Currently Amended) A mesoporous synthetic polymer hydrogel permeation layer overlying an electrode on a substrate, wherein the permeation layer comprises mesopores which are between about 100 nm and 1000 nm across, wherein the permeation layer is covalently anchored to the electrode and wherein the electrode comprises a silicon-containing conductive material.

2. (Original) The mesoporous synthetic polymer hydrogel permeation layer of claim 1 wherein the mesopores are between about 100 nm and about 500 nm across.

3. (Original) The mesoporous synthetic polymer hydrogel permeation layer of claim 1 wherein the mesopores are between about 200 nm and about 500 nm across.

4. (Original) The mesoporous synthetic polymer hydrogel permeation layer of claim 1 wherein the permeation layer further comprises micropores which are between about 1.0 μm and 3.0 μm across.

5. (Original) The mesoporous synthetic polymer hydrogel permeation layer of claim 4 wherein the micropores are between about 1.0 μm and 2.0 μm across.

6. (Original) The mesoporous synthetic polymer hydrogel permeation layer of claim 4 wherein the micropores are between about 1.0 μm and 1.5 μm across.

7. (Original) The mesoporous synthetic polymer hydrogel permeation layer of claim 1 wherein the permeation layer is between about 0.5 μm and about 10 μm thick when dry.

8. (Original) The mesoporous synthetic polymer hydrogel permeation layer of claim 1 wherein the permeation layer is between about 1.0 μm and about 5.0 μm thick when dry.

9. (Original) The mesoporous synthetic polymer hydrogel permeation layer of claim 1 wherein the permeation layer is between about 1.0 μm and about 2.0 μm thick when dry.

10. (Original) The mesoporous synthetic polymer hydrogel permeation layer of claim 1 wherein the polymer comprises a polymerized acryloyl or acrylamido monomer.

11. (Original) The mesoporous synthetic polymer hydrogel permeation layer of claim 10 wherein the acryloyl or acrylamido monomer is an acrylamide.

12. (Original) The mesoporous synthetic polymer hydrogel permeation layer of claim 10 wherein the acryloyl or acrylamido monomer is an *N*-substituted acrylamide.

13. (Original) The mesoporous synthetic polymer hydrogel permeation layer of claim 10 wherein the acryloyl or acrylamido monomer is an *N*-substituted methacrylamide.

14. (Original) The mesoporous synthetic polymer hydrogel permeation layer of claim 10 wherein the acryloyl or acrylamido monomer is methacrylamide.

15. (Original) The mesoporous synthetic polymer hydrogel permeation layer of claim 1 wherein the permeation layer is covalently anchored to the electrode.

16. (Canceled)

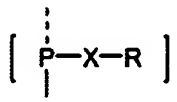
17. (Currently Amended) The mesoporous synthetic polymer hydrogel permeation layer of ~~claim 16~~ claim 1 wherein the electrode comprises a material selected from the group consisting of: platinum silicide, titanium silicide, gold silicide, and tungsten silicide.

18. (Original) The mesoporous synthetic polymer hydrogel permeation layer of claim 1 wherein the permeation layer is covalently anchored to the substrate around the electrode.

19. (Original) The mesoporous synthetic polymer hydrogel permeation layer of claim 18 wherein the permeation layer is further covalently anchored to the electrode.

20. (Original) The mesoporous synthetic polymer hydrogel permeation layer of claim 1 wherein the permeation layer comprises a copolymerized attachment moiety for the attachment of specific binding entities.

21. (Original) The mesoporous synthetic polymer hydrogel permeation layer of claim 20 wherein the specific binding entity is copolymerized with the synthetic polymer hydrogel through a structure of the general formula:



wherein,

P is a polymerizable moiety covalently attached to one or two moieties selected from the group consisting of: a monomeric unit of the synthetic polymer and another P-X-R group, as defined herein, wherein the other P-X-R group may be the same as or different from the first P-X-R group, further wherein the dashed line is a covalent bond to the second moiety if P is covalently attached to two moieties;

X is a covalent bond or a linking moiety; and

R is a functional moiety for attaching, either covalently or non-covalently, a biomolecule.

22. (Original) The mesoporous synthetic polymer hydrogel permeation layer of claim 21 wherein R is attached to a biomolecule.

23. (Original) The mesoporous synthetic polymer hydrogel permeation layer of claim 22 wherein the biomolecule is a nucleic acid.

24. (Original) The mesoporous synthetic polymer hydrogel permeation layer of claim 22 wherein the biomolecule is a protein.

25. (Original) The mesoporous synthetic polymer hydrogel permeation layer of claim 21 wherein R is selected from the group consisting of biotin, avidin, streptavidin, and another biotin binding moiety.

26. (Original) The mesoporous synthetic polymer hydrogel permeation layer of claim 21 wherein R is streptavidin.

27. (Original) The mesoporous synthetic polymer hydrogel permeation layer of claim 21 wherein R is selected from the group consisting of aldehyde, carboxylic acid, acyl halide, succinimidyl, maleimidyl, thiol, hydrazide, hydrazine, amine, ester, thioester, ketal, and disulfide moieties.

28-31. (Canceled)

32. (Original) The mesoporous synthetic polymer hydrogel permeation layer of claim 21 wherein P is selected from the group consisting of acrylamide, acrylate, methacrylate, methacrylamide, allyl, amino, and epoxy moieties.

33. (Original) The mesoporous synthetic polymer hydrogel permeation layer of claim 21 wherein P is an acryloyl or acrylamido moiety.

34. (Original) The mesoporous synthetic polymer hydrogel permeation layer of claim 21 wherein X is a covalent bond.

35. (Canceled)

36. (Currently Amended) A mesoporous synthetic polymer hydrogel permeation layer overlying an electrode on a substrate, wherein the permeation layer has a θ value between about 2.0 and about 4.0 when compared to a standard permeation layer composition S (Acrylamide: Bisacrylamide 19:1 mol/mol, total monomer content 20% by weight), wherein θ is defined by the equation:

$$\theta \equiv \frac{\lambda - \lambda_0}{\lambda_S - \lambda_0} \approx \frac{\lambda}{\lambda_S}$$

wherein integrated light intensity readings λ are taken using dark field microscopy on a compound optical microscope of the dry hydrogel permeation layer on the substrate (λ), the standard permeation layer (λ_S)and a non-phase separated or solid layer (λ_0)..

37. (Original) The mesoporous synthetic polymer hydrogel permeation layer of claim 36 wherein the permeation layer has a θ value between about 2.0 and about 3.8 when compared to composition S.

38. (Original) The mesoporous synthetic polymer hydrogel permeation layer of claim 36 wherein the permeation layer has a θ value between about 2.0 and about 3.0 when compared to composition S.

39. (Original) The mesoporous synthetic polymer hydrogel permeation layer of claim 36 wherein the permeation layer has a θ value between about 3.0 and about 3.8 when compared to composition S.

40. (Original) The mesoporous synthetic polymer hydrogel permeation layer of claim 36 wherein the permeation layer is between about 0.5 μm and about 10 μm thick when dry.

41. (Original) The mesoporous synthetic polymer hydrogel permeation layer of claim 36 wherein the permeation layer is between about 1.0 μm and about 5.0 μm thick when dry.

42. (Original) The mesoporous synthetic polymer hydrogel permeation layer of claim 36 wherein the permeation layer is between about 1.0 μm and about 2.0 μm thick when dry.

43. (Original) The mesoporous synthetic polymer hydrogel permeation layer of claim 36 wherein the polymer comprises a polymerized acryloyl or acrylamido monomer.

44. (Original) The mesoporous synthetic polymer hydrogel permeation layer of claim 43 wherein the acryloyl or acrylamido monomer is an acrylamide.

45. (Original) The mesoporous synthetic polymer hydrogel permeation layer of claim 43 wherein the acryloyl or acrylamido monomer is an *N*-substituted acrylamide.

46. (Original) The mesoporous synthetic polymer hydrogel permeation layer of claim 43 wherein the acryloyl or acrylamido monomer is an *N*-substituted methacrylamide.

47. (Original) The mesoporous synthetic polymer hydrogel permeation layer of claim 43 wherein the acryloyl or acrylamido monomer is methacrylamide.

48. (Original) The mesoporous synthetic polymer hydrogel permeation layer of claim 36 wherein the permeation layer is covalently anchored to the electrode.

49. (Original) The mesoporous synthetic polymer hydrogel permeation layer of claim 48 wherein the electrode comprises a silicon-containing conductive material.

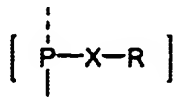
50. (Original) The mesoporous synthetic polymer hydrogel permeation layer of claim 49 wherein the electrode comprises a material selected from the group consisting of: platinum silicide, titanium silicide, gold silicide, and tungsten silicide.

51. (Original) The mesoporous synthetic polymer hydrogel permeation layer of claim 36 wherein the permeation layer is covalently anchored to the substrate around the electrode.

52. (Original) The mesoporous synthetic polymer hydrogel permeation layer of claim 51 wherein the permeation layer is further covalently anchored to the electrode.

53. (Original) The mesoporous synthetic polymer hydrogel permeation layer of claim 36 wherein the permeation layer comprises a copolymerized attachment moiety for the attachment of specific binding entities.

54. (Original) The mesoporous synthetic polymer hydrogel permeation layer of claim 53 wherein the specific binding entity is copolymerized with the synthetic polymer hydrogel through a structure of the general formula:



wherein,

P is a polymerizable moiety covalently attached to one or two moieties selected from the group consisting of: a monomeric unit of the synthetic polymer and another P-X-R group, as defined herein, wherein the other P-X-R group may be the same as or different from the first P-X-R group, further wherein the dashed line is a covalent bond to the second moiety if P is covalently attached to two moieties;

X is a covalent bond or a linking moiety; and

R is a functional moiety for attaching, either covalently or non-covalently, a biomolecule.

55. (Original) The mesoporous synthetic polymer hydrogel permeation layer of claim 54 wherein R is attached to a biomolecule.

56. (Original) The mesoporous synthetic polymer hydrogel permeation layer of claim 55 wherein the biomolecule is a nucleic acid.

57. (Original) The mesoporous synthetic polymer hydrogel permeation layer of claim 55 wherein the biomolecule is a protein.

58. (Original) The mesoporous synthetic polymer hydrogel permeation layer of claim 54 wherein R is selected from the group consisting of biotin, avidin, streptavidin, and another biotin binding moiety.

59. (Original) The mesoporous synthetic polymer hydrogel permeation layer of claim 54 wherein R is streptavidin.

60. (Original) The mesoporous synthetic polymer hydrogel permeation layer of claim 54 wherein R is selected from the group consisting of aldehyde, carboxylic acid, acyl halide, succinimidyl, maleimidyl, thiol, hydrazide, hydrazine, amine, ester, thioester, ketal, and disulfide moieties.

61. (Original) The mesoporous synthetic polymer hydrogel permeation layer of claim 54 wherein R is a hydrazide moiety.

62. (Original) The mesoporous synthetic polymer hydrogel permeation layer of claim 54 wherein R is a succinimidyl ester moiety.

63. (Original) The mesoporous synthetic polymer hydrogel permeation layer of claim 54 wherein R is an aldehyde moiety.

64. (Original) The mesoporous synthetic polymer hydrogel permeation layer of claim 54 wherein R is a psoralen moiety.

65. (Original) The mesoporous synthetic polymer hydrogel permeation layer of claim 54 wherein P is selected from the group consisting of acrylamide, acrylate, methacrylate, methacrylamide, allyl, amino, and epoxy moieities.

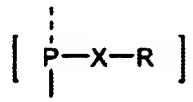
66. (Original) The mesoporous synthetic polymer hydrogel permeation layer of claim 54 wherein P is selected an acryloyl or acrylamido moiety.

67. (Original) The mesoporous synthetic polymer hydrogel permeation layer of claim 54 wherein X is a covalent bond.

68. (Original) The mesoporous synthetic polymer hydrogel permeation layer of claim 54 wherein X is a polyalkylene glycol linker.

69-85. (Canceled)

86. (New) A mesoporous synthetic polymer hydrogel permeation layer overlying an electrode on a substrate, wherein the permeation layer comprises mesopores which are between about 100 nm and 1000 nm across, wherein the permeation layer comprises a copolymerized attachment moiety for the attachment of specific binding entities, and wherein the specific binding entities are copolymerized with the permeation layer according to a structure of the



general formula:

wherein,

P is a polymerizable moiety covalently attached to one or two moieties selected from the group consisting of: a monomeric unit of the synthetic polymer and another P-X-R group, as defined herein, wherein the other P-X-R group may be the same as or different from the first P-X-R group, further wherein the dashed line is a covalent bond to the second moiety if P is covalently attached to two moieties;

X is a covalent bond or a linking moiety; and

R is a functional moiety for attaching, either covalently or non-covalently, a biomolecules, wherein **R** is selected from the group consisting of a hydrazide, succinimidyl ester, aldehyde, and psoralen moiety.

87. (New) The mesoporous synthetic polymer hydrogel permeation layer of claim 86 wherein P is selected from the group consisting of acrylamide, acrylate, methacrylate, methacrylamide, allyl, amino, and epoxy moieties.

88. (New) The mesoporous synthetic polymer hydrogel permeation layer of claim 86 wherein P is an acryloyl or acrylamido moiety.

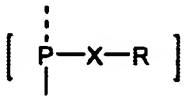
89. (New) The mesoporous synthetic polymer hydrogel permeation layer of claim 86 wherein X is a covalent bond.

90. (New) The mesoporous synthetic polymer hydrogel permeation layer of claim 86 wherein R is attached to a biomolecule.

91. (New) The mesoporous synthetic polymer hydrogel permeation layer of claim 90 wherein the biomolecule is a nucleic acid.

92. (New) The mesoporous synthetic polymer hydrogel permeation layer of claim 90 wherein the biomolecule is a protein.

93. (New) A mesoporous synthetic polymer hydrogel permeation layer overlying an electrode on a substrate, wherein the permeation layer comprises mesopores which are between about 100 nm and 1000 nm across, wherein the permeation layer comprises a copolymerized attachment moiety for the attachment of specific binding entities, and wherein the specific binding entities are copolymerized with the permeation layer according to a structure of the general formula:



wherein,

P is a polymerizable moiety covalently attached to one or two moieties selected from the group consisting of: a monomeric unit of the synthetic polymer and another P-X-R group, as defined herein, wherein the other P-X-R group may be the same as or different from the first P-X-R group, further wherein the dashed line is a covalent bond to the second moiety if P is covalently attached to two moieties;

X is a polyalkylene glycol linker; and

R is a functional moiety for attaching, either covalently or non-covalently, a biomolecules.

94. (New) The mesoporous synthetic polymer hydrogel permeation layer of claim 93 wherein P is selected from the group consisting of acrylamide, acrylate, methacrylate, methacrylamide, allyl, amino, and epoxy moieties.

95. (New) The mesoporous synthetic polymer hydrogel permeation layer of claim 93 wherein P is an acryloyl or acrylamido moiety.

96. (New) The mesoporous synthetic polymer hydrogel permeation layer of claim 93 wherein X is a covalent bond.

97. (New) The mesoporous synthetic polymer hydrogel permeation layer of claim 93 wherein R is attached to a biomolecule.

98. (New) The mesoporous synthetic polymer hydrogel permeation layer of claim 97 wherein the biomolecule is a nucleic acid.

99. (New) The mesoporous synthetic polymer hydrogel permeation layer of claim 97 wherein the biomolecule is a protein.

100. (New) The mesoporous synthetic polymer hydrogel permeation layer of claim 93 wherein R is selected from the group consisting of biotin, avidin, streptavidin, and another biotin binding moiety.

101. (New) The mesoporous synthetic polymer hydrogel permeation layer of claim 93 wherein R is streptavidin.

102. (New) The mesoporous synthetic polymer hydrogel permeation layer of claim 93 wherein R is selected from the group consisting of aldehyde, carboxylic acid, acyl halide, succinimidyl, maleimidyl, thiol, hydrazide, hydrazine, amine, ester, thioester, ketal, and disulfide moieties.

103. (New) The mesoporous synthetic polymer hydrogel permeation layer of claim 93 wherein R is selected from the group consisting of a hydrazide, succinimidyl ester, aldehyde, and psoralen moiety.